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Diabetes Diagnostic Expert System using Website-Based Forward Chaining Method

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Abstract

Diabetes is a chronic disease. The World Health Organization predicts that Indonesia's number of diabetic patients will continue to increase significantly to 16.7 million in 2045. As early prevention, early diagnosis is needed to anticipate more severe diabetes. This study aims to build an expert system for detecting diabetes using a web-based forward chaining method. The expert system is built by collecting indications from experts by collecting facts using the forward chaining method. Furthermore, judging by the unhealthy lifestyle of many people who consult with hospitals or health workers. From the results obtained, the system can work well based on knowledge from experts.

Keywords: Diabetes, forward chaining, diabetes mellitus, web

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1. Introduction

Diabetes Mellitus (DM) is a chronic disease characterized by blood glucose levels (blood sugar) exceeding normal, namely blood sugar levels at the same time or more than 200 mg / dl and sugar levels [1]. Blood when fasting is more or equal to 126 mg/dl [2]. Indonesia is ranked 5th country with the largest number of people with diabetes in the world. As many as 19.47 million Indonesians out of the entire population of 179.72 million, or the percentage of diabetes in Indonesia is 10.6% [3].

Assisting health workers in diagnosing early, alternatives are needed in the early identification of diabetes symptoms [4]. Diagnosis can be *supported* by Artificial Intelligence (AI) with *algorithms forward chaining* as a help to experts. *The algorithm forward chaining* is a step of reasoning by making the facts that can be used as knowledge to make them conclusions. It starts from the facts that will be determined as an expert system, the premise of which is determined by the *user* who is referred to as the expert system.

Expert *System* is a branch of *Artificial Intelligent* (AI), a program systemized in a computer that contains knowledge from one or more experts or people who are experts in solving a problem specifically and in detail [5]. The increase in diabetics in Indonesia will cause many patients heading to health workers with the same symptoms. Solving problems that occur using an expert system can help health workers to estimate the number of people affected by the symptoms of diabetes. The diagnosis of diabetes mellitus that is currently carried out is still manual and less efficient, namely through consultation with a doctor. With this web-based expert system, it can make it easier for health workers and patients in the process of early diagnosis of diabetes mellitus through website access.

The previous study was titled a web-based diabetes mellitus diagnosis expert system using forward chaining methods" [6]. The study used a *forward chaining* method with 11 symptoms and 2 decision tables and was designed using PHP web programming . Where in the study, diabetes mellitus disease was analyzed only 2 types, type 1 diabetes mellitus and type 2 diabetes mellitus. In the user interface, you can see the admin form which will be able to make the user confused. So this study develops facts and symptoms that are not only for people with diabetes mellitus, but also the initial symptoms of diabetes.

So, this study took a slightly wider scope by taking the types of early symptoms of diabetes, symptoms of diabetes mellitus, and other types of diabetes mellitus, with the hope that *users* will be able to correctly get their accuracy. In addition, the *user interface* is built more *friendly* so that users can easily access it without any

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difficulty in using it. Thus, as many people know about the symptoms of diabetes more and more people to maintain a healthy lifestyle [7].

2. Research Methods

This study contains activities related to the examination of the initial symptoms of diabetes as an effort to detect diabetes mellitus early using a *website* that is easier to use. The stages of the study will be described as follows.

2.1. Data Collection Methods

The method of collecting data on the facts used for the process of creating an expert system in research is.

a. Interview
   Interviews are conducted to get information that can later help increase knowledge related to the facts of diabetes symptoms to doctors and people who experience it or patients. So that the objectives of the research can be achieved according to the objectives.
b. Literature Studies
   Literature study is a step by which authors look for references from journals and the web related to research. In this case the author chose a literature study to collect facts of the symptoms of diabetes mellitus from journals and the web.

2.2. System Development Methods

The development method is used to design and build systems with *the forward chaining method. Forward chaining* obtained from a form of facts that starts from the fact data obtained in order to draw conclusions from the existing facts. Collecting some existing facts or statements then leads to conclusions [7].

The *forward chaining* method of existing data facts (*facts*) starts from the knowledge of the facts of experts towards a goal (*goal*). The *forward chaining* method can use IF-THEN rules which are from premise (IF) to conclusion (THEN) [8].

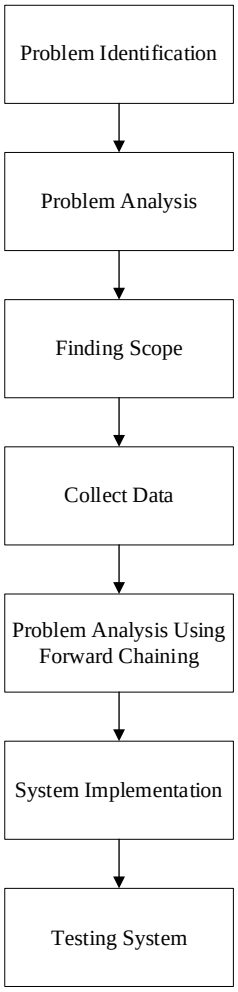

Figure 1. Research Flow

3. Results and Discussion

The design of the diabetes mellitus symptom diagnosis algorithm is found in Figure 2 and Table 1.

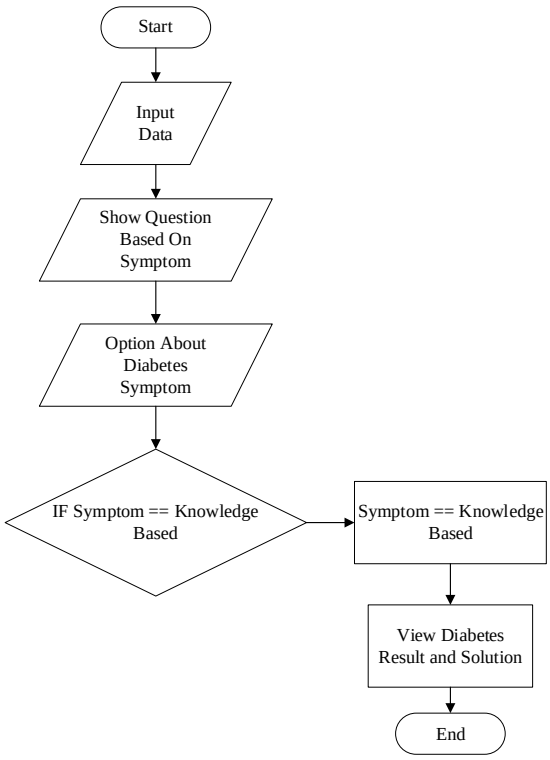

Figure 2. Diabetic disease algorithm design

Table 1. Symptom

Symptom								Variable /Diagnos s
Easy thirst and hunger	Easy to get tired	Excessive urination	Weight loss	Blurred vision	Wounds heal for a long time	Blood sugar rises during pregnancy	Symptoms do not appear obvious, get worse	
a	**b**	**c**	**d**	**e**	**g**	**g**	**h**	
√	√							Early Symptoms of Diabetes
√		√						
√			√					
√				√				
	√	√						
	√		√					
	√			√				
		√	√					
√	√							Symptoms of Diabetes Mellitus
√	√							
√	√							
√		√						
√		√						
√			√					
	√	√						
	√	√						
	√		√					
	√			√				
		√	√					
√	√							Malitus Type 1 Diabetes
√	√							
√	√							
√	√							
√	√							
√	√							Symptoms of Type 2 Diabetes Mellitus
√	√							
√	√							
√		√						
√		√						
√			√					
	√	√						
	√	√						
	√		√					
	√			√				
		√	√					
√	√						√	Type 2 Diabetes Mellitus
√	√						√	
√	√						√	
√		√					√	
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√			√	√			√
	√	√	√				√
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√	√			√		√	
√		√	√			√	
√		√		√		√	
√			√	√		√	
	√	√	√			√	
	√	√		√		√	
		√	√	√		√	
√	√	√	√	√		√	

Other Type Diabetes

Based on Table 1, the second column describes the various symptoms of diabetes. The third column and its seturus explain the conclusions of the various symptoms of diabetes. Ceklis is a symptom that is experienced then becomes facts that will later be concluded [9]. While the last line is an explanation of the conclusions of the diagnosis results of the symptoms of diabetes [10].

3.1. Rules on the expert system

Rule 1: **If you** experience hunger and thirst **and** fatigue then you are diagnosed with symptoms of diabetes.

If you experience 2 symptoms in pairs between thirsty and hungry, easily tired, excessive urination, weight loss, blurred vision of the eyes have a diagnosis of early symptoms of diabetes.

Rule 2: If you experience easy thirst and **hunger** and easily tired **and** urinate excessively**, the** symptoms of diabetes mellitus are diagnosed**.**

If you experience 3 symptoms with a pair between thirsty and hungry, easy fatigue, excessive urination, weight loss, blurred vision then have a diagnosis of diabetes mellitus symptoms.

Rule 3: If you experience easy thirst and hunger and easily tired and urinate excessively **and** lose weight , then diabetes mellitus type 1 is diagnosed.

If you experience 4 symptoms in pairs between thirsty and hungry, easy to get tired, excessive urination, weight loss, blurred vision then have a diagnosis of symptoms of type 1 diabetes mellitus.

Rule 4: If you experience easy thirst and hunger and easily tired and excessive urination and wounds heal for a long time **, then** at the initial diagnosis of symptoms of type 2 diabetes mellitus.

If you experience 3 symptoms with a pairing between thirsty and hungry, easy fatigue, excessive urination, weight loss blurred vision, every 3 symptoms accompanied by a wound heals for a long time then have a diagnosis of symptoms of type 2 diabetes mellitus.

Rule 5: If you experience thirst and hunger **easily** and easily tired and urinate excessively and the symptoms get worse without realizing it**, then** at the initial diagnosis of type 2 diabetes mellitus symptoms

If you experience 3 symptoms in pairs between thirsty and hungry, easy fatigue, excessive urination, weight loss blurred vision, every 3 symptoms and accompanied by initial symptoms that get worse without realizing it, have a diagnosis of type 2 diabetes mellitus

Rule 6: If you experience easy thirst and hunger and easily tired and urinate excessively**, the** symptoms of diabetes mellitus are diagnosed

If you experience 3 symptoms with a pairing between thirsty and hungry, easy fatigue, excessive urination, weight loss, blurred vision, and accompanied by a 24-week pregnant state then have a diagnosis of symptoms of other types of diabetes [11].

Table 2. Description of diabetes disease

No	Symptom	System Diagnosis Results
1.	1. Easy Thirst and Hunger. 2. Easy to get tired. Excessive urination. 3. Weight loss.	Early Symptoms of Diabetes
2.	1. Easy Thirst and	

	Hunger. 2. Easy to get tired. 3. Excessive urination. 4. Weight loss is getting lower.	Symptoms of Diabetes Mellitus
3.	1. Easy Thirst and Hunger. 2. Easy to get tired. 3. Excessive urination. Weight loss is getting lower. 4. Blurred vision.	Diabetes Mellitus Type 1
4.	1. Easy Thirst and Hunger. 2. Easy to get tired. 3. Excessive urination. Weight loss is getting lower. 1. Blurred vision. 2. Long healing wounds.	Symptoms of Diabetes Mellitus Type 2
5.	1. Easy Thirst and Hunger. 2. Easy to get tired. Excessive urination. 3. Weight loss is getting lower. 4. Blurred vision. 5. Long healing wounds. 6. The initial symptoms are not obvious. But slowly, it will worsen.	Diabetes Mellitus Type 2
6.	1. Easy Thirst and Hunger. 2. Easy to get tired. 3. Excessive urination. 4. Weight loss. 5. Blurred vision. 6. Sugar Content	Other Types of Diabetes Mellitus

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Table 3. Description of symptoms

Kode	Symptom
a	Easy thirst and hunger
b	Easy to get tired
c	Excessive urination
d	Weight loss
e	Blurred vision
f	Long healing wounds
g	Sugar levels rise in pregnant women
h	Initial Symptoms Are Not Obvious But Getting Worse

3.2 Web needs analysis

Specification of web needs of an expert system on the diagnosis of diabetes disease with *forward chaining*.

1. Visitors choose the tutorial menu to find out the function and how to use the web to detect diabetes
2. Visitors choose the diagnosis menu in order to have a health consultation to find out diabetes and see solutions for prevention efforts.

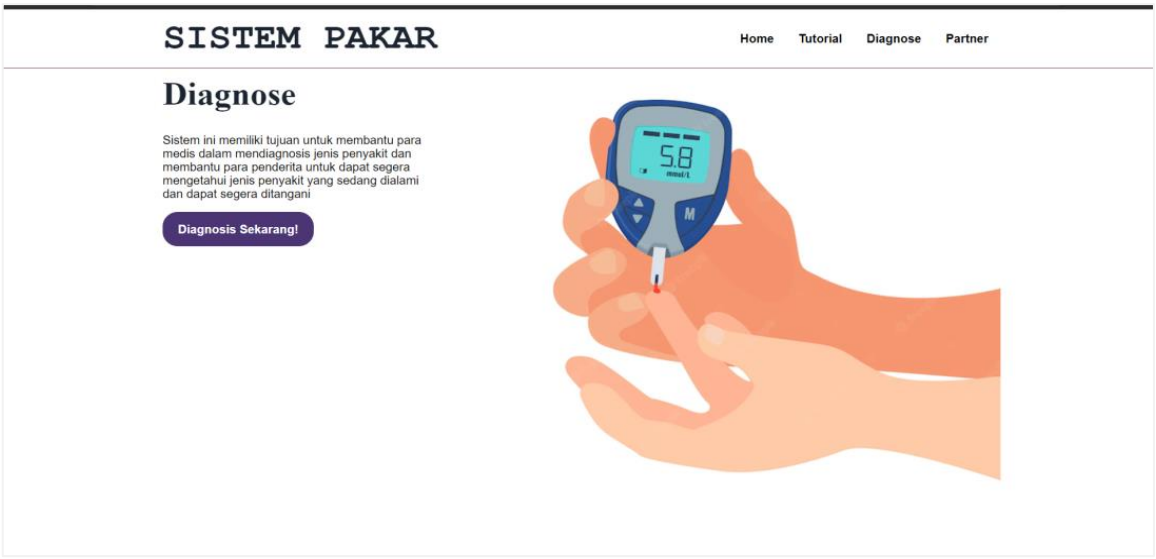

Figure 1. Visitor page views

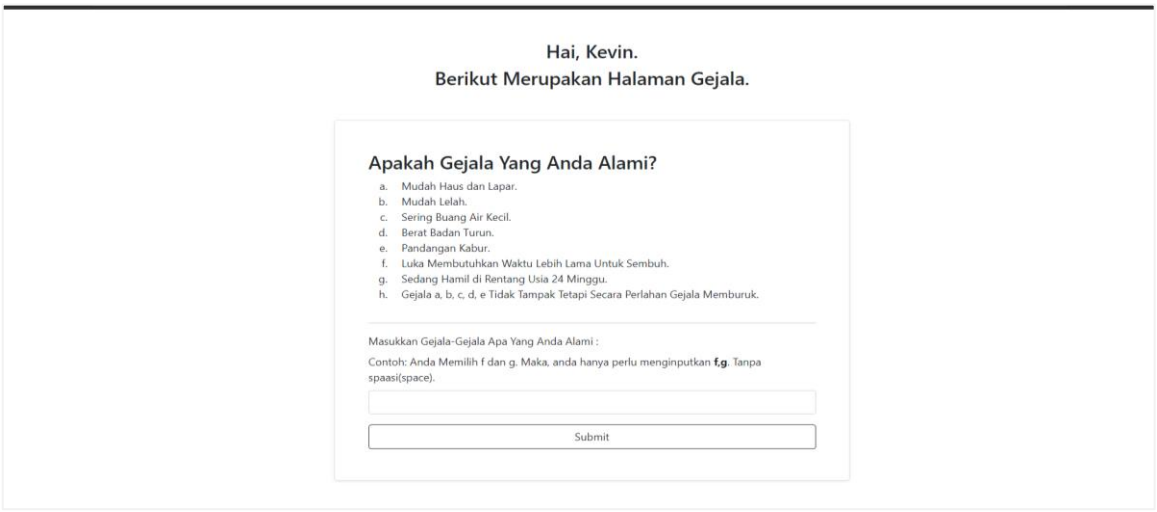

Figure 2. Health consultation page views

1. Visitors can use the web by filling in personal data and what symptoms are being suffered so that the web is able to detect
2. Visitors get a solution to prevent the disease after diagnosing.

3.3. *Use Interface*

The initial web view can be seen in Figure 3, there are various menus for diagnosis and tutorials before using *the website* and the diabetic diagnosis page display can be seen Figure 4.

4. Conclusion

People with diabetes can occur in everyone around us. Prevention early can benefit the sufferer. The expert system built has demonstrated appropriate performance to support the diagnosis of diabetes symptoms in anticipation of worse conditions. In addition, this *website-based* expert system makes it easier for people to maintain a better lifestyle.

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